Can we understand the black hole information paradox by studying its history?

By: Jeroen van Dongen & Sebastian de Haro

In 1976, following his earlier result that black holes evaporate, Stephen Hawking proposed that they also introduce a fundamental non-unitary evolution of quantum states. This claim was generally well received, until a substantial number of articles in the mid1980s began disputing it. Their authors were primarily at home in quantum field theory rather than general relativity, while relativists appeared to side with Hawking's perspective. Hawking, meanwhile, in 1982 formulated a formal version of his non-unitary evolution scenario, as particle physicists quickly claimed that this produced problems with energy conservation. The debate was gridlocked for an extensive period, even though it gained prominence and attracted an ever greater number of discussants. Can we understand the gridlock if we view both sides as at home in different paradigms in which translation problems and a lack of shared theoretical values prevailed? Yet, what may then explain the motion towards consensus that the last decade has shown? And can we identify principle' vs. constructive' approaches in attempts to resolve the issues? In this talk, we will try to see if the quantum black hole problem, a typical 'borderline problem' in which general relativity, quantum theory, and thermodynamics meet, can be enlightened by studying the dynamics of its history. At the same time, this will show how various fundamental principles and practices are weighed differently in different communities of theoretical physics.